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MANAGEMENT AND FEEDING OF YOUNG DAIRY ANIMALS

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INTRODUCTION

One of the dairyman's major expenses is providing replacement animals for his milking herd. Inadequate feeding slows growth and sexual development, and delays the start of first lactation. These delays are costly for dairymen who must feed and care for unproductive animals that otherwise could be providing income. Proper feeding and good disease-prevention measures for young calves provide heifers that are ready to start their first lactation at about 2 years of age.

Calf management and feeding programs are changing continually. Old systems that included a long period of feeding whole milk and skim milk have been replaced by limited whole milk or milk-replacer feeding schemes in which the calf is weaned at 4–6 weeks old and raised on dry feeds. Feeding once a day and the use of cold milk and sour colostrum are other practices now receiving attention.

This publication describes feeding and management practices that promote good growth and development rates. These recommendations are for replacement heifers from the time the fetus is developing until the start of the first lactation. Brief sections are also included that deal with veal and dairy-

beef production as alternate methods of marketing surplus dairy calves.

CARE OF THE PREGNANT COW

Proper feeding of the pregnant cow is important during the last 2 months of pregnancy because the developing fetus makes two-thirds of its growth during this time, resulting in a marked increase in the cow's energy and protein requirements over maintenance. The cow is normally dry during most of this period, but if she is fed a balanced diet she will gain in weight and condition and thereby ensure satisfactory nutrition for fetal development. Strong healthy calves are easier to raise than small weak ones. Inadequate prenatal nutrition produces small weak calves with nutritional deficiencies, slow growth, and increased mortality.

Allow the pregnant cow a 2-month dry period to build up reserves of energy, calcium, and phosphorus to meet the needs of the next lactation and to develop the fetus sufficiently. Supply a balanced diet of all the good roughage the cow will eat and a concentrate mixture and mineral supplement to ensure the buildup of the body reserves. Add vitamin A if stored forage is being fed.

Several days before the calf is due, separate the cow from the herd and move her to a clean, well-bedded box stall or a small field close to the barn where she can be watched. Usually a cow gives birth to her calf without help, but be prepared to help during the delivery and to call in veterinary assistance if needed.

THE NEWBORN CALF

Early management

A healthy calf attempts to nurse about an hour after it is born. Help weak calves to stand and nurse during the first 2 hours. Separate the calf from the cow after 12–18 hours. It is easy to teach calves to drink at this age, and the separation worries the cow less. Early separation reduces the possibility of the calf overeating or picking up infection from the calving quarters. Place the newborn calf in a clean disinfected pen, free from drafts, but well ventilated.

Feeding for the first 3 days

Colostrum, the first milk produced by the cow during the first few days after parturition, is essential to the calf. It

contains antibodies that counteract disease and is somewhat laxative. Colostrum provides high levels of protein, vitamins A and D, thiamine, and riboflavin. It is richer in iron than normal milk. Therefore, the calf should receive colostrum, preferably within 4 hours of birth, when the protective globulins are absorbed more completely. Colostrum feeding may continue for 2 or 3 days. Because the first-day colostrum has twice the solids content of normal milk, it should be diluted with an equal amount of water for feeding to older calves. Surplus colostrum may be frozen and stored for later use.

Two feedings a day are usually enough, but small weak calves may benefit from three feedings a day for the first week. Feed colostrum at 6–8 pounds (2.7–3.6 kg) a day to large calves, 4–6 pounds (1.8–2.7 kg) to small ones. Overfeeding colostrum often causes scours.

3 DAYS TO 3 MONTHS

The first 6–8 weeks are the most critical in calf rearing. During this time the calf is most susceptible to digestive up-

Fig. 1. Individual calf pens that can be dismantled and thoroughly cleaned.

sets and infections of the digestive and respiratory tracts. Also during this period the animal develops from a single-stomached animal into a ruminant. Proper diet, especially the early feeding of hay and grain, is important to stimulate rumen development.

To prevent the spread of infection, keep the calves in individual pens (Fig. 1). Slatted-floor pens are recommended, because they reduce the floor space needed per animal, and they simplify feeding and cleaning procedures. However, with the use of elevated slatted-floor pens, careful attention must be given to temperature, ventilation, and freedom from drafts.

Methods of feeding

Feed calves at the same time each day. The milk or milk replacer should be at the same temperature at each feeding. Regularity in time of feeding, temperature of the milk, and amount fed helps to reduce digestive upsets.

Open pail versus nipple pail Most dairymen prefer to use open pails for feeding. Nipple pails are harder to clean and are more susceptible to sanitation problems. Also, older calves can pull the nipples off and waste the milk. However, some dairymen believe there is a psychological benefit from using a nipple pail.

Nurse cows Nurse cows from the milking herd are often used to raise several calves. You can reduce labor by using nurse cows. Follow the procedure outlined under "Veal Production," but with less emphasis on rapid gains. Give replacement calves meal and hay besides the milk from the nurse cow.

Mechanical feeders Mechanical feeders are used to feed calves on milk replacer. These feeders are equipped to mix the replacer with the proper amount of water in a control tank and to pump it to the nursing stations fitted with nipples. This method reduces labor requirements when a large number of calves are being fed. Mechanical feeders are used mainly for feeding veal calves or calves on intensive dairy–beef production programs. The drawbacks with this method are the risk of spreading disease and the damage from sucking navels and udders, because these calves are usually group fed.

Frequency of feeding

Feed large healthy calves milk or milk replacer twice a day. Feed small, weak calves three times a day for the first week. Recent studies have shown that once-a-day feeding can replace twice-a-day feeding of milk replacer without harming

the calves. If you follow the once-a-day feeding regime, mix the daily allowance of replacer for two feedings with the same or slightly more than the amount of water for one feeding. Once-a-day feeding allows you to feed the calves at the most convenient time during the day. Provide plenty of clean, fresh water, meal, and hay at all times. This is especially important with once-a-day feeding.

Rate of feeding

The amount of milk to feed depends on the size of the calf. Do not overfeed, because digestive upsets and scours may result. The daily feeding schedule for dairy calves on whole milk, milk replacer, or skim milk is given in Table 1.

TABLE 1. DAILY FEEDING SCHEDULE FOR DAIRY CALVES

	Whole milk, pounds/day (kg/day)		or Milk replacer, pounds/day (kg/day)		or Skim milk, pounds/day (kg/day)	
Age	Large calf	Small calf	Large calf	Small calf	Large calf	Small calf
1–4 days	6–8 (2.7–3.6)	4–6 (1.8–2.7)				
5–9 days	8 (3.6)	6 (2.7)	0.6 (0.27)	0.5 (0.23)		
2nd week	9 (4.1)	7 (3.2)	1.0 (0.45)	0.8 (0.36)		
3rd week	10 (4.5)	8 (3.6)	1.0 (0.45)	0.8 (0.36)		
4th week	9 (4.1)	8 (3.6)	1.2 (0.54)	1.0 (0.45)	10 (4.5)	8 (3.6)
5th week	8 (3.6)	6 (2.7)	1.2 (0.54)	1.0 (0.45)	Gradually increase amounts up to 20 pounds/day (9 kg/day). The amount fed depends on the size of calf. Feed less to small calves.	
6th week	8 (3.6)	6 (2.7)	1.2 (0.54)	1.0 (0.45)		
7–12 weeks						

When the amount of milk offered is reduced, the calf will eat more starter meal and hay, and show less setback at weaning.

Liquid feeding programs

Whole milk During the first 2 weeks feed the calf whole milk at up to 10% of its body weight per day. After 3 weeks, increase the daily milk allowance to 12% of the calf's body weight. When the calf is a few days old, offer dry feed that includes both a calf starter and a good-quality fine hay to encourage consumption of dry feed. This regime will help eliminate milk feeding as early as possible.

Feed milk at body temperature, if possible, at about 90–100°F (32–38°C). Accurately measure the amount fed to avoid over- or under-feeding. Warm milk is more eagerly accepted, but studies have shown that calves will do just as well on cold milk. Keep the temperature consistent once cold milk has been started at 2 or 3 weeks of age. Use milk from healthy cows that are free from clinical mastitis.

Milk replacer Milk replacer is used extensively for rearing dairy calves after they are about 1 week old. Milk replacers are usually diluted in seven or eight parts water. Follow the manufacturer's instructions. For faster growth, you may exceed slightly the manufacturer's recommended feeding levels.

Commercial replacers vary from low fat (1–10%) to high fat (10–20%) levels, and they may contain milk products (skim milk, dried buttermilk, and whey) or cereal products, soybean meal, or other sources of nutrients. The cost increases with higher fat levels and decreases with higher plant material content. Usually the carbohydrates from plant sources in a milk replacer are poorly utilized by the young calf, and they cause digestive upsets and retard the rate of growth. It is best to avoid replacers that contain cereal products. The most suitable milk replacers consist entirely of milk products and have a high level of fat added. However, recent research has shown that protein from fish and soybean meal can be used satisfactorily in milk replacers. For information on the ingredients in a milk replacer, write to the Feed and Fertilizer Unit, Plant Products Division, Production and Marketing Branch, Ottawa. Be sure to include the name of the manufacturer and the registration number of the product that you are inquiring about.

The rates for feeding milk replacer are given in Table 1. Mix the replacer in the recommended amount of water before you give it to the calves.

Fresh skim milk Fresh skim milk is an excellent feed for calves. It can be substituted for whole milk when the calves are 2–3 weeks old. The change can be made abruptly, or gradually over 3 days. When calves are about 4 weeks old, if skim milk is in plentiful supply, the amount fed may be gradually increased to 20 pounds (9 kg) a day for large calves, less for small calves. Continue to feed skim milk until the calves are 4–5 months old, but make the transition to dry feeding gradually, regardless of age.

Skim milk does not contain vitamins A or D. Provide

these vitamins from another source. They are available commercially in both a dry form for adding to the feed and an injectable form containing vitamins A, D, and E.

Sour colostrum Colostrum not fed to calves during the first few days can be placed in a plastic container and allowed to sour. Colostrum from more than one cow can be mixed together. Calves can be abruptly changed to sour colostrum. If a calf refuses the sour colostrum, mix it with fresh colostrum or milk for a few days. One part hot water should be mixed with three parts sour colostrum just before feeding. Feed the same amount of the mixture of water and sour colostrum as for whole milk.

Fresh whey Fresh whey fed at 14–16 pounds (6.3–7.2 kg) per day produces satisfactory results. Because whey is low in protein, it is best to feed high-protein starter and good legume hay at the same time. Do not feed whey to calves under 4 weeks old, because of its laxative effect.

Calf starter meal

When the calf is 2–3 days old, begin feeding it a calf starter meal. Feed only small amounts at first and keep fresh meal in front of the calf. One technique is to place some meal in the pail after milk feeding. An early start on dry feed helps stimulate development of the rumen function.

In contrast with earlier formulations for calf starters, which were complex mixtures of many feeds and supplements, recommendations now stress simpler grain mixtures, supplemented with protein, minerals, and vitamins. Several cereal grains or by-products with a protein supplement, a source of calcium and phosphorus, salt, and vitamins A, D, and E make satisfactory calf starters. Several suggested mixtures for calf starters are given in Table 2.

Several starter feeding programs may be followed after weaning. One program is to feed hay free-choice plus limited amounts of an 18–20% starter. The amount of starter should be increased up to 4–6 pounds (1.8–2.7 kg) per day as soon as the calf will eat it. Continue with this amount up to 12–14 weeks of age. The amount of starter eaten varies somewhat, depending on the quality of the forage and the size of the calf.

An alternative program is to feed free-choice a complete starter mixture, which includes about 10% ground hay. About 16% crude protein is satisfactory when such a mixture is fed without additional hay, up to 12–14 weeks of age.

TABLE 2. CALF STARTER MIXTURES

Ingredients	Ration 1, parts	Ration 2, parts	Ration 3, parts	Ration 4,* parts
Ground hay			10	
Rolled barley	50		57	50
Rolled oats	20	28	10	24
Cracked corn		40		
Soybean meal (50%)†	18	20	15	14
Alfalfa meal	5	5		5
Molasses	5	5	5	5
Calcium phosphate	1	1	2	1
Salt (cobalt-iodized)	1	1	1	1
Vitamin A	1000 IU/pound (2200 IU/kg) in all rations			
Vitamin D	150 IU/pound (330 IU/kg) in all rations			

*Low-protein mixture may be combined with skim-milk feeding.
†Linseed oil meal or rapeseed meal (up to 10%) may be substituted for soybean meal. Adjust the quantity added according to the crude protein level of the supplement used.

With a long milk-feeding period, provide 15–16% crude protein in the starter mixture. At 12–14 weeks of age, calves may be switched to a grower mixture.

Calves have been shown to adapt to urea-containing starter mixtures. Growth may be slowed slightly, but more economical gains are possible. No harmful effects have been observed in calves fed urea-containing starters. Molasses may be added to improve palatability and to reduce dustiness of calf starter mixtures.

WHEN TO WEAN

The recommended age for weaning a calf has changed in recent years. Experiments have shown that the milk-feeding period can be reduced considerably and that calves make rapid and economical gains on dry feeds.

Age is most commonly used as a guide for weaning. However, studies have shown that calves of the same age vary greatly in development. At birth, a heavy calf is better developed than a light calf of the same breed, and the heavy calf keeps this advantage for some time. Nevertheless, most calves can be satisfactorily weaned at 4–6 weeks of age.

The amount of dry feed eaten daily is another guide that can be used to determine when to wean. Calves that eat about 1 pound (0.45 kg) of dry meal a day can be weaned with almost no setback. After they reach this level of intake, weaned

calves soon eat more dry feed to compensate for the nutrients previously supplied in the milk. This method is easy to follow, because you wean the calves when they are ready to adjust to dry feeds.

3 TO 9 MONTHS

When calves are 3 months old, the rumen is sufficiently developed for the calf to make good growth on forage and a moderate amount of concentrate. Silage may be introduced at 3 months of age by offering 1–2 pounds (0.5–1 kg) at the start, and by 9 months of age the calves will eat up to 10 pounds (4.5 kg) or more of silage and about the same amount of hay.

At Ottawa, studies have shown that in this age group calves born in spring make satisfactory gains on good-quality pasture (Fig. 2). When calves are on succulent pasture, it is best to add some hay and a little grain to ensure adequate gains. To minimize the risk of internal parasites, rotate calves on fresh pasture not previously grazed by adult animals. Move the calves every 2 or 3 weeks. Shade is important. Spray or dust the calves regularly for protection against flies.

Fig. 2. Calves grazing pasture.

At 3 months, replace calf starter with calf grower (14–16% crude protein) or the regular milking-herd concentrate (16% crude protein). Grower formulas, as given in Table 3, should produce good results.

TABLE 3. CALF GROWER MIXTURES

Ingredients	Ration 1, parts	Ration 2, parts	Ration 3, parts
Crushed oats	30	48	68
Crushed barley*	58	40	20
Soybean meal†	10	10	10
Salt (cobaltized-iodized)	1	1	1
Calcium phosphate	1	1	1

*Cracked corn may replace crushed barley.
†Linseed oil meal or up to 10% rapeseed meal may be used to replace soybean meal.

At 4 months of age, calves should eat 4–6 pounds (1.8–2.7 kg) of concentrate a day. If you are providing good-quality roughage, reduce the grain-concentrate allowance to 2–4 pounds (1–2 kg) at 6 months of age. Some dairymen discontinue grain supplement at 9 months of age, but the grain allowance should be regulated to maintain the growth rates shown in Table 4.

Well-cured leafy hay provides the essential vitamins A and D, whereas B vitamins are synthesized in the rumen. If the forage is of poor quality or has been stored a long time, add a vitamin supplement to provide 1000 IU of vitamin A and 150 IU of vitamin D per pound (2200 IU of vitamin A and 330 IU of vitamin D per kilogram) of grower.

DEVELOPMENT THROUGH BREEDING AND PREGNANCY

As heifers approach breeding age they grow well on good-quality roughage without supplement. If only poor-quality roughage is available or if pasture becomes depleted, provide grain supplement to maintain their growth. Well-grown heifers reach the production stage earlier and more economically than those whose growth has been retarded.

Do not overfeed heifers, because they may become too fat. A number of experiments have been carried out to determine the effect of level of feeding and age at first breeding

TABLE 4. GROWTH TABLE FOR WEIGHT AND HEIGHT OF FEMALE DAIRY CALVES

Age, months	Holstein		Ayrshire		Jersey	
	Weight, pounds (kg)	Withers height, inches (m)	Weight, pounds (kg)	Withers height, inches (m)	Weight, pounds (kg)	Withers height, inches (m)
Birth	90 (40.5)	29.0 (0.73)	72 (32.4)	27.6 (0.69)	55 (24.8)	25.7 (0.64)
1	115 (51.8)	30.5 (0.75)	89 (40.1)	28.6 (0.72)	70 (31.5)	27.0 (0.68)
2	155 (69.8)	32.2 (0.81)	119 (53.6)	30.2 (0.76)	95 (42.8)	28.8 (0.72)
3	205 (92.3)	34.3 (0.86)	158 (71.1)	31.9 (0.80)	135 (60.7)	30.6 (0.77)
4	260 (117.0)	36.3 (0.91)	198 (89.1)	34.0 (0.85)	175 (78.8)	32.7 (0.82)
5	318 (143.1)	37.7 (0.94)	245 (110.3)	35.5 (0.89)	220 (99.0)	34.5 (0.86)
6	380 (171.0)	39.5 (0.99)	293 (131.9)	37.2 (0.93)	270 (121.5)	36.1 (0.90)
7	438 (197.1)	41.2 (1.03)	344 (154.8)	38.5 (0.96)	315 (141.8)	37.6 (0.94)
8	490 (220.5)	42.5 (1.06)	389 (175.1)	39.9 (1.00)	360 (162.0)	39.0 (0.98)
9	543 (244.4)	43.6 (1.09)	433 (194.9)	40.9 (1.02)	395 (175.8)	40.0 (1.00)
10	590 (265.5)	44.5 (1.11)	469 (211.1)	41.7 (1.04)	430 (193.5)	41.0 (1.03)
11	635 (285.8)	45.2 (1.13)	502 (225.9)	42.5 (1.06)	465 (209.3)	41.8 (1.05)
12	685 (308.3)	46.0 (1.15)	538 (242.1)	43.2 (1.08)	495 (222.8)	42.4 (1.06)
14	753 (338.9)	47.5 (1.19)	611 (274.9)	44.8 (1.12)	550 (247.5)	43.5 (1.09)
16	820 (369.0)	48.6 (1.22)	669 (301.1)	45.7 (1.14)	600 (270.0)	44.6 (1.12)
18	890 (400.5)	49.5 (1.24)	725 (326.3)	46.5 (1.16)	645 (290.3)	45.4 (1.14)
20	960 (432.0)	50.5 (1.26)	793 (356.9)	47.4 (1.19)	695 (312.8)	46.2 (1.16)

Adapted from Missouri Agricultural Experimental Station data, Bulletin 336, 1934, by A. C. Ragsdale, and data from other sources.

on subsequent production performance. Results show that heifers fed to maintain normal growth rate (*see* Table 4) and bred to calve early (24 months) usually have higher total yields during their productive life than heifers that were bred later. However, heifers below normal in growth rate that are bred early may have difficulties in calving.

MANAGEMENT

Type of pen and housing

Place early weaned calves in individual pens to avoid calves sucking each other and bruising and damaging appendages. When calves are 3 months old they can stay in their individual pens, or calves of similar size can be penned in groups. Provide pens of simple structure that can be thoroughly cleaned. Place forage and concentrate containers for easy access for cleaning and refilling. Arrange watering facilities to prevent soiling from droppings. Concrete floors are easiest to keep clean. Replace bedding of straw or shavings as soon as it is soiled. Raised, slatted floors or expanded metal floors are very satisfactory. Heat lamps suspended over the calf stalls are an economical way of providing extra heat. At the Animal Research Institute, Ottawa, calves are kept in individual pens on expanded metal floors until they are 3 months old. In these pens, no bedding is needed and feces soiling is insignificant.

Calves over 3 months of age and heifers that are not pastured may be housed in free-stall or slatted-floor barns. These facilities provide good accommodation and reduce the labor as compared with traditional floor pens. Good ventilation is needed in all types of barns. Heifers should be divided into groups of similar size to minimize injuries from fighting and to ensure that smaller animals have equal access to the feed bunk. Open and bred heifers are easier to observe when they are penned in separate groups.

Dehorning

Several methods of dehorning calves may be used: electric dehorners, commercial caustic preparations, or caustic soda. Each method is effective, but satisfactory results seem to depend more on the efficiency of the operator than on the method used. Dehorn the calves when they are 2–4 weeks old. If the calves are dehorned when they are older, their horn stubs may become crooked and unsightly.

Fig. 3. Horn being removed by an electric dehorner.

Electric dehorners (Fig. 3) are recommended. For best results, gently gouge out the core at the instant the horn rim is scorched.

If you use caustic preparations, apply a coating of vaseline around the base of the horn to prevent burning the hair or skin. Apply just enough caustic to cover the horn button. Keep the calves in individual pens during this dehorning operation to prevent burns from contact.

Removing supernumery teats

Supernumery or extra teats may cause trouble when the heifer comes into lactation. They often leak milk, or are partly webbed to normal teats. Examine the calf's mammary glands at 1 month of age. Cut off extra teats with sterilized short-bladed scissors. Apply a swab of iodine to the cut to avoid infection. When two teats are joined, have a veterinarian remove the extra one.

Identification methods

Ear tags, tattoos, or photographs are used to identify calves. Photographs are used mainly with registration certificates for identifying purebred animals. A tattoo between the two central ribs of the ear is a reasonably durable identification, but suitable tattooing ink has not been developed for animals with black ears.

A satisfactory system is to tag calves at birth with a locking ear tag. To be sure that the tag locks properly on the ear, use pliers especially designed for this purpose. Apply the tag to the upper edge of the ear, about 2 inches (5 cm) from the base of the ear to allow for growth. Use tags stamped in sequence with any suitable numbering system. Number the tags to identify the calf by herd number, year, and order of birth. For example, the number 17418 indicates that the calf is from herd no. 1, was born in 1974, and is the 18th calf born in that herd during the year.

MALE CALVES FOR VEAL OR BEEF

Veal production

Low returns and risk of diseases have discouraged large-scale veal production. However, with suitable facilities available, healthy male calves (Fig. 4) of good birth weight give reasonable returns when raised for veal. Generally the heavier calves at birth, over 90 pounds (40 kg), produce the highest profit.

The same rules of good management and rearing apply for raising veal calves as for raising replacement calves.

Provide individual pens 5 feet (1.5 m) long and 2 feet (0.6 m) wide that have solid sides 3–3½ feet (0.9–1.1 m) high, which minimize drafts. A steady temperature between 55 and 65°F (12 and 18°C) reduces demands of food energy to maintain body temperature, and results in more efficient conversion of food to meat.

For the first week or two, calves that are being raised for white veal production should be fed the same diet as replacement calves. Make sure that they receive the full allowance of colostrum. Do not give them, even the larger calves, more than 8 pounds (3.6 kg) of milk daily for the first week or 10 days. After the second week, give the calves only milk or milk replacer at 10–12% of body weight. Gradually increase the intake after 3 or 4 weeks of age to the maximum intake

Fig. 4. Male calves. *Left:* Shorthorn, 62 pounds (28 kg); *center:* Cross-bred, 75 pounds (34 kg); *right:* Holstein, 94 pounds (42 kg).

without digestive upset. As calves approach slaughter weight increase the daily allowance to 16%, or higher, of body weight.

When feeding commercial high-energy milk replacer that contains added fat (vealer), mix the powder and water at 1:10 by weight for the second and third weeks, and at 1:7 for the remaining weeks to market. Follow the directions for feeding veal calves that are supplied with the milk replacer.

Table 5 shows the amount of milk or replacer (vealer) needed for two feedings daily for veal calves.

To increase the daily gains, particularly during the first 6 weeks, supplement the milk with an antibiotic (25 mg of chlortetracycline, oxytetracycline, or a mixture of both). Commercial milk replacers are usually fortified with antibiotics and the essential vitamins A and D.

Some dairymen prefer to raise veal calves with the help of nurse cows. Nursed calves usually make the fastest gains and require the least labor. Keep the nurse cow in a box stall

TABLE 5. DAILY AMOUNTS OF MILK OR MILK REPLACER FOR VEAL CALVES

Age, weeks	Whole milk, pounds (kg)	Milk replacer powder, pounds (kg)
2	11 (5.0)	1.2 (0.5)
3	16 (7.2)	1.8 (0.8)
4	20 (9.0)	2.5 (1.1)
5	25 (11.3)	3.0 (1.4)
6	30 (13.5)	4.0 (1.8)

and let the calves in twice daily for feeding. The number of calves assigned to a cow depends on the ability of the nurse cow to meet each calf's daily needs. Two calves can be started on a fresh cow that produces a moderate amount of milk. Increase the number of calves to three or four as the nurse cow reaches her peak production. Reduce the number of calves as their feed requirements increase, and transfer them to another nurse cow or feed them from a pail. Make sure that all udder quarters are sucked dry. Under good management, a cow with a production potential of 10,000 pounds (4500 kg) of milk can nurse the equivalent of 9 or 10 calves during a lactation.

Although there are no specific weights for officially grading veal, a liveweight of 210–250 pounds (95–113 kg) is the most economical weight for marketing finished veal (Fig. 5). Because the desired weight of veal varies in different markets, it is wise to keep informed on market demands in order to obtain maximum returns. Veal is graded by degree of fleshing, interior finish, and color of fat and lean.

Under good management, 10 pounds (4.5 kg) of whole milk or 1–1.5 pounds (0.5–0.7 kg) of vealer will produce 1 pound (0.45 kg) of gain. With this information, you can estimate the cost of producing veal in comparison with market prices for a suitable return.

The appetite demands of calves weighing over 250 pounds (113 kg) increase the cost of feeding milk or milk substitutes. However, if the feed is changed to grain or roughage at this stage, the color of the meat tends to deepen, which may lower the grade and reduce the returns.

Veal versus beef production

The returns from raising male dairy calves for veal or

Fig. 5. Choice veal carcass, hide on, 135 pounds (61 kg).

beef depend on trends in market prices, facilities for rearing the stock, time of birth, and good husbandry. The early returns from the larger males finished as veal may be balanced by the less costly feeding out for beef at 18 months of age, including a season of good pasture.

Intensive feeding of Holstein-Friesian steers on all-grain rations (Fig. 6) will produce over 2.5 pounds (1.13 kg) of gain per day from 200 to 1000 pounds (90 to 450 kg) of liveweight, resulting in marketable steers in less than 1 year from birth. Feed efficiency under this kind of program is about

Fig. 6. Holstein-Friesian steers on all-grain rations.

5–6 pounds (2.3–2.7 kg) of feed per pound (0.45 kg) of gain. Suggested rations are given in Table 6. No other feed is needed, but the feed and plenty of fresh water must be available to the animals at all times.

TABLE 6. RATIONS FOR INTENSIVE DAIRY BEEF PRODUCTION

Ingredients	Starting ration to 300 pounds (135 kg) liveweight, %	Growing–finishing rations		
		Ration 1, %	Ration 2, %	Ration 3, %
Crushed barley	72	80		90
Cracked corn			74	
Soybean meal	19	12	18	
Urea				2
Molasses	5	5	5	5
Dicalcium phosphate	3	2	2	2
Salt (iodized-cobaltized)	1	1	1	1
Vitamin A	10 million IU/ton (11.1 million IU/tonne) in all rations			
Vitamin D	2.5 million IU/ton (2.75 million IU/tonne) in all rations			

COMMON DISEASES

Good husbandry is very important in combating disease during the critical first 3 weeks of a calf's life.

Scours

Scours is the most common disease of young calves. The extent of infection varies from noninfectious "digestive scours" to greater bacterial infection causing white pasty feces, "white scours," and cases where blood is passed in the feces, called "red scours."

Colostrum contains antibodies that combat most of the strains of bacteria *(coli)* that cause scours. This disease is most likely to be introduced when calves or pregnant cows are brought in from another farm or sale barn.

To cure mild digestive scours, reduce the quantity of milk fed for two or three feedings. For more severe cases, reduce the milk allowance for two or three feedings and replace one milk feeding entirely with warm water containing ½ tablespoon (7.5 ml) of baking soda, 2 tablespoons (30 ml) of common salt, and 4 oz (113 g) of corn syrup in 1 gallon (4.5 litres) of water. This treatment helps overcome dehydration caused by scours. For severe cases of infection, shown by continuing diarrhea, high temperature, loss of appetite, and sunken eyes, call a veterinarian. Immediately isolate from the main calf-rearing area any calves showing symptoms of scours.

Pneumonia

Pneumonia may occur in calves at any time. It may develop when calves are exposed to sudden chills, drafty quarters, or when another disease such as scours lowers the calf's resistance.

Dullness, coughing, and rapid breathing are symptoms of pneumonia. Keep healthy calves away from any calves showing these symptoms. This disease should be treated with sulfa drugs and antibiotics.

Ringworm

Ringworm is a fungus growth that occurs in rings on the skin and causes loss of hair and formation of scabs on the infected area. Treatment is effective when the infection is detected early and treated promptly. Loosen the scab with a stiff brush, preferably of fine wire, and apply and thoroughly

rub in a medication such as tincture of iodine and salicylic acid. Clean the pens thoroughly and dispose of the refuse away from animal areas.

PESTS

Internal parasites

Several kinds of stomach and intestinal parasites (roundworms) may infect the digestive tract of calves. Infection usually occurs when the calf swallows larvae that have developed from eggs passed in the feces of infected animals.

Symptoms vary with the species of organism. Anemia as shown by paleness of mouth and eyes, rough hair in coat, and stunted growth, may result from parasite infestation. Good husbandry is important in preventing infection. Do not overcrowd calf quarters and do not graze calves on pastures that have recently been used by older animals.

Lungworms in the trachea and small air passages of the lungs affect the calf's breathing. Heavy infestations of lungworms can be fatal. Symptoms of affected animals are coughing, labored breathing, loss of appetite, and intermittent diarrhea. Good husbandry and sanitation are the best means of prevention. Do not pasture calves on areas that have recently been grazed by older animals. Infected animals should be treated. Consult your veterinarian for the proper medication to treat intestinal parasites and lungworms.

Flies and lice

Stable flies, house flies, horn flies, and face flies breed in manure and moist waste-feed accumulations. To reduce the number of flies, remove these materials regularly every day or so.

Warble flies are propagated from eggs laid on the lower extremities of an animal. In 4 or 5 days the eggs hatch into maggots, which penetrate the skin and remain in the animal during the winter, migrating to the loin area and erupting from swellings of the skin in spring.

Infestations of lice may occur during winter confinement.

For information about controlling flies and lice, consult your agricultural representative or livestock specialist.

CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:	
LINEAR			
inch	x 25	millimetre	(mm)
foot	x 30	centimetre	(cm)
yard	x 0.9	metre	(m)
mile	x 1.6	kilometre	(km)
AREA			
square inch	x 6.5	square centimetre	(cm^2)
square foot	x 0.09	square metre	(m^2)
acre	x 0.40	hectare	(ha)
VOLUME			
cubic inch	x 16	cubic centimetre	(cm^3)
cubic foot	x 28	cubic decimetre	(dm^3)
cubic yard	x 0.8	cubic metre	(m^3)
fluid ounce	x 28	millilitre	(ml)
pint	x 0.57	litre	(ℓ)
quart	x 1.1	litre	(ℓ)
gallon	x 4.5	litre	(ℓ)
bushel	x 0.36	hectolitre	(hl)
WEIGHT			
ounce	x 28	gram	(g)
pound	x 0.45	kilogram	(kg)
short ton (2000 lb)	x 0.9	tonne	(t)
TEMPERATURE			
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	degrees Celsius	(°C)
PRESSURE			
pounds per square inch	x 6.9	kilopascal	(kPa)
POWER			
horsepower	x 746	watt	(W)
	x 0.75	kilowatt	(kW)
SPEED			
feet per second	x 0.30	metres per second	(m/s)
miles per hour	x 1.6	kilometres per hour	(km/h)
AGRICULTURE			
gallons per acre	x 11.23	litres per hectare	(ℓ/ha)
quarts per acre	x 2.8	litres per hectare	(ℓ/ha)
pints per acre	x 1.4	litres per hectare	(ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare	(ml/ha)
tons per acre	x 2.24	tonnes per hectare	(t/ha)
pounds per acre	x 1.12	kilograms per hectare	(kg/ha)
ounces per acre	x 70	grams per hectare	(g/ha)
plants per acre	x 2.47	plants per hectare	(plants/ha)

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